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New digitization strategies for relativistic quantum field theories NIKLAS MUELLER, Brookhaven National Lab, JOAO BARATA, Universidade de Santiago de Compostela, Spain, ANDREY TARASOV, OSU, RAJU VENUGOPALAN, Brookhaven National Lab — Quantum computers may become powerful tools to simulate various problems in quantum field theory, yet at present are restricted to lower dimensions and small volumes. Common digitization strategies are based on local Hilbert-space decomposition, which may not be optimal for systems with large volumes but few (or not so few) particles. Examples are (non-relativistic) quantum chemistry or low energy nuclear physics, but also relativistic systems in high energy scattering experiments. Using a relativistic scalar ϕ^4 theory as a simple example, we propose a novel single-particle digitization strategy for relativistic quantum field theories and discuss quantum simulating S-matrix scattering experiments. For such problems our strategy uses significantly less resources than other approaches. We discuss renormalization and Lorentz covariance, and application in low energy nuclear physics.

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